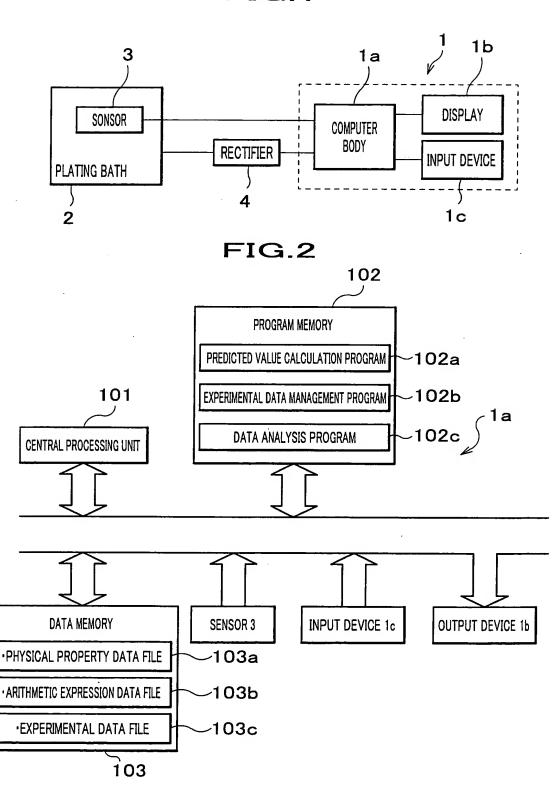YAMAMOTO   Q68543
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FIG.1

FIG.2

FIG.3

START

EXPERIMENTAL CONDITIONS ARE INPUT. — S1

SOLUTION TEMPERATURE AND pH VALUE ARE INPUT. — S2

PREDICTED VALUES OF EXPERIMENTAL RESULT ARE WORKED OUT. — S3

PREDICTED VALUES ARE PRESENTED. — S4

NO — EXPERIMENT IS CARRIED OUT ? — S5

YES

EXPERIMENT IS CARRIED OUT. — S6

S7 — EXPERIMENTAL CONDITIONS ARE CHANGED ? — YES — EXPERIMENTAL CONDITIONS ARE CHANGED. — S8

NO — S9

EXPERIMENTAL RESULTS ARE PRESENTED.

EXPERIMENTAL RESULTS ARE SAVED. — S10

END
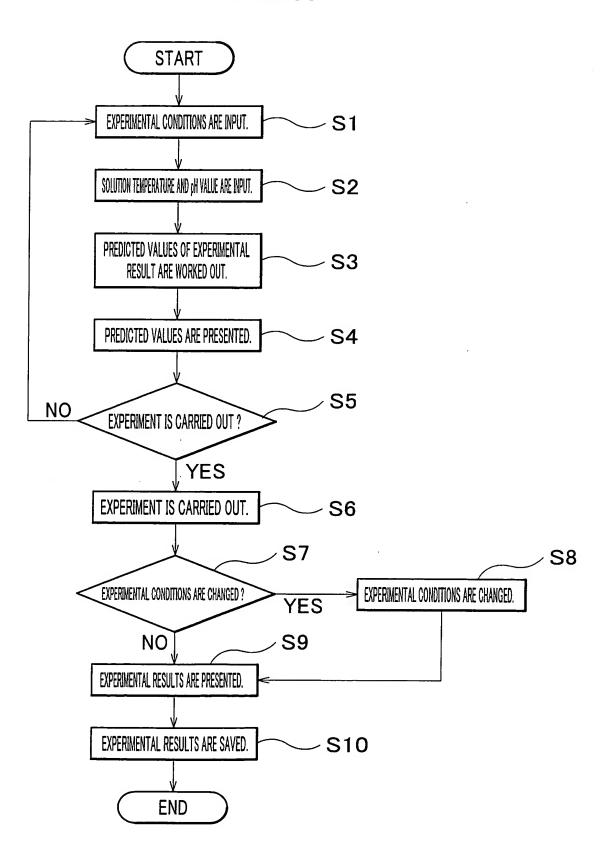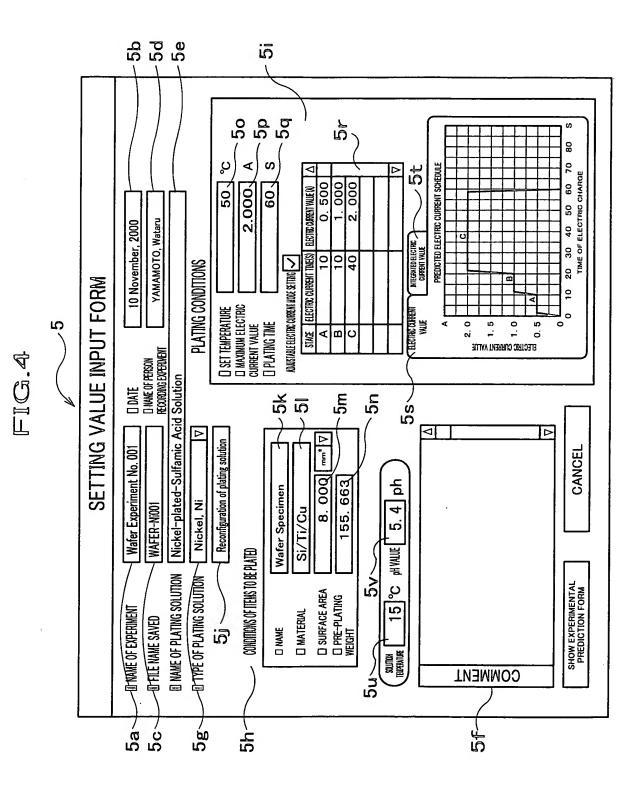
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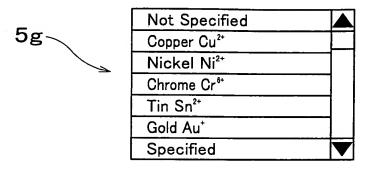202-293-7060
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FIG. 4

SETTING VALUE INPUT FORM — 5

- ☐ NAME OF EXPERIMENT — 5a — Wafer Experiment No. 001
- ☐ FILE NAME SAVED — 5c — WAFER-Ni001
- ☐ NAME OF PLATING SOLUTION — Nickel-plated-Sulfamic Acid Solution
- ☐ TYPE OF PLATING SOLUTION — 5g — Nickel, Ni ▷
  - 5j — Reconfiguration of plating solution
- ☐ DATE — 5b — 10 November, 2000
- ☐ NAME OF PERSON RECORDING EXPERIMENT — 5d — YAMAMOTO, Wataru
  - 5e

CONDITIONS OF ITEMS TO BE PLATED — 5h

- ☐ NAME — 5k — Wafer Specimen
- ☐ MATERIAL — 5l — Si/Ti/Cu
- ☐ SURFACE AREA — 5m — 8.00Q mm² ▷
- ☐ PRE-PLATING WEIGHT — 5n — 155.663

SOLUTION TEMPERATURE — 5u — 15 °C   5v — pH VALUE — 5.4 ph

PLATING CONDITIONS — 5i

- ☐ SET TEMPERATURE — 5o — 50 °C
- ☐ MAXIMUM ELECTRIC CURRENT VALUE — 5p — 2.000 A
- ☐ PLATING TIME — 5q — 60 s

ADJUSTABLE ELECTRIC CURRENT MODE SETTING ☑

STAGE	ELECTRIC CURRENT TIME(S)	ELECTRIC CURRENT VALUE (A)
A	10	0.500
B	10	1.000
C	40	2.000

5r

ELECTRIC CURRENT VALUE — INTEGRATED ELECTRIC CURRENT VALUE — 5t — 5s

PREDICTED ELECTRIC CURRENT SCHEDULE

(graph — ELECTRIC CURRENT VALUE vs TIME OF ELECTRIC CHARGE; ELECTRIC CURRENT VALUE axis: 2.0, 1.5, 1.0, 0.5; TIME OF ELECTRIC CHARGE axis: 0 10 20 30 40 50 60 70 80 s; curves A, B, C)

COMMENT — 5f

SHOW EXPERIMENTAL PREDICTION FORM   CANCEL

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FIG.5A

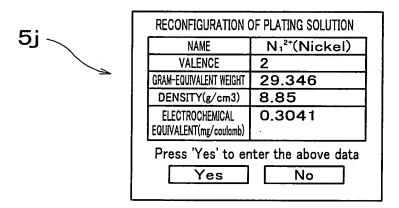|	
Not Specified	▲
Copper Cu^{2+}	
Nickel Ni^{2+}	
Chrome Cr^{6+}	
Tin Sn^{2+}	
Gold Au^{+}	
Specified	▼

5g

FIG.5B

5j

RECONFIGURATION OF PLATING SOLUTION	
NAME	N$_1$$^{2+}$(Nickel)
VALENCE	2
GRAM-EQUIVALENT WEIGHT	29.346
DENSITY(g/cm3)	8.85
ELECTROCHEMICAL EQUIVALENT(mg/coulomb)	0.3041

Press 'Yes' to enter the above data

Yes	No

FIG.5C

5t

INTEGRATED ELECTRIC CURRENT VALUE

MAXIMUM ELECTRIC CURRENT VALUE	2 A	TOTAL TIME OF CHARGE	60 S	INTEGRATED ELECTRIC CURRENT VALUE	60 C

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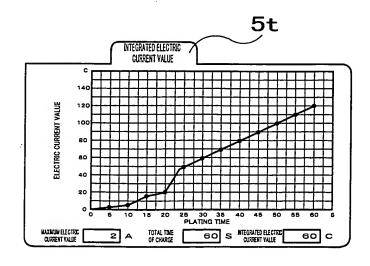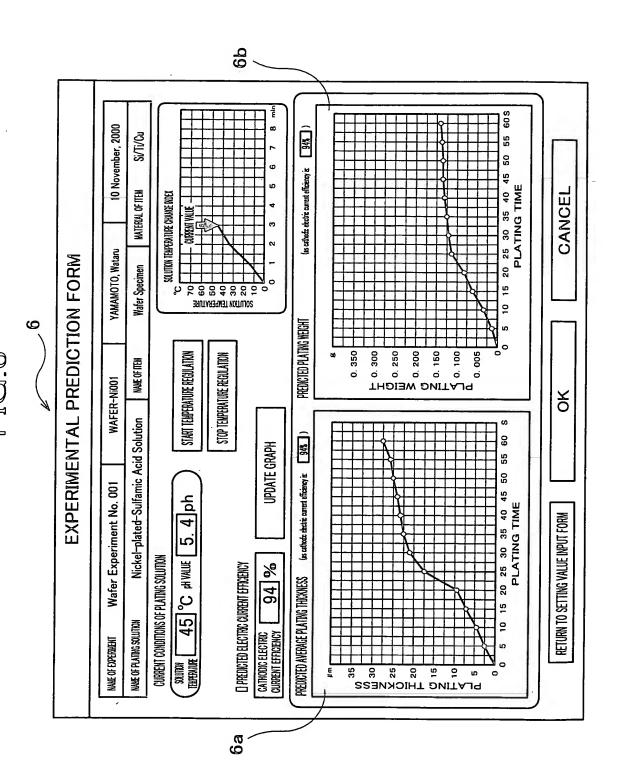Filed: February 19, 2002
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FIG.6

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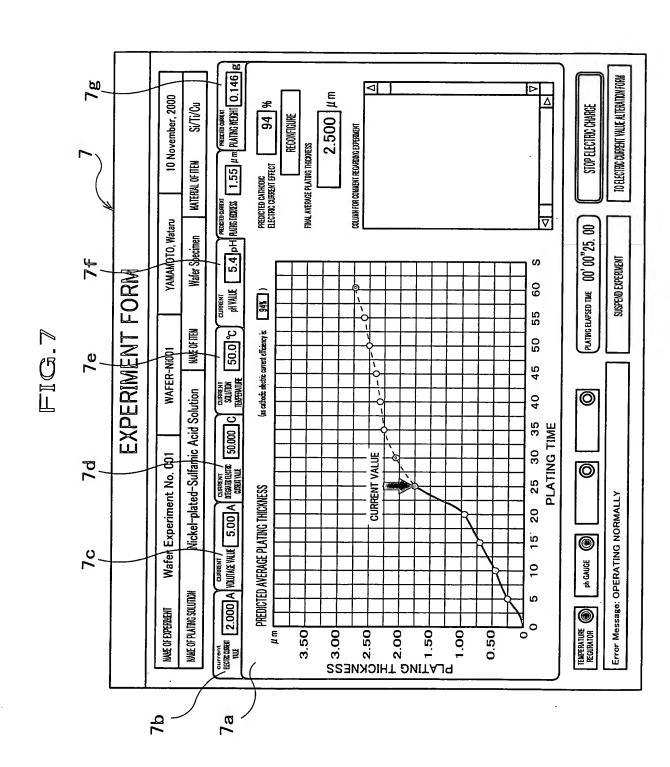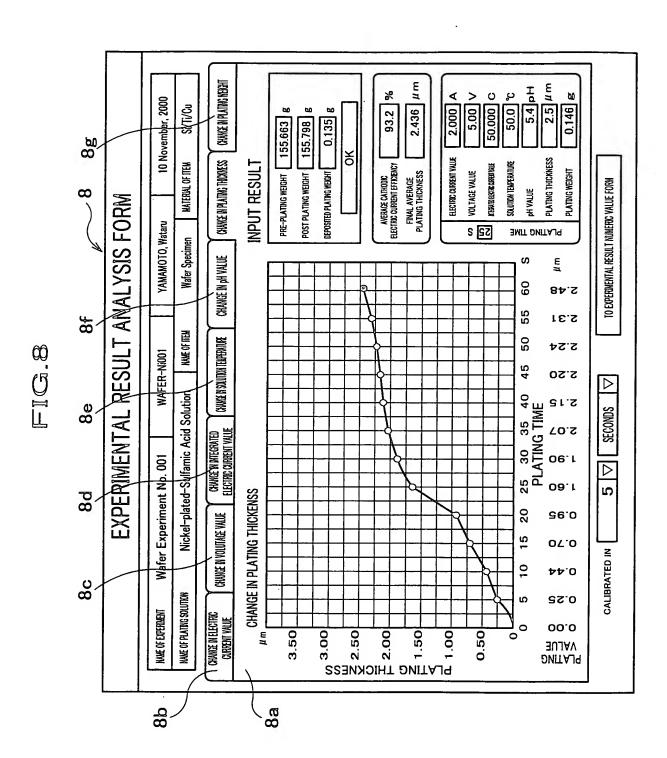202-293-7060
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FIG.7

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FIG.8

EXPERIMENTAL RESULT ANALYSIS FORM

| NAME OF EXPERIMENT | Wafer Experiment No. 001 | WAFER-Ni001 | YAMAMOTO, Wataru | 10 November, 2000 |
| NAME OF PLATING SOLUTION | Nickel-plated-Sulfamic Acid Solution | NAME OF ITEM | Wafer Specimen | MATERIAL OF ITEM | Si/Ti/Cu |

8b — CHANGE IN ELECTRIC CURRENT VALUE
8c — CHANGE IN VOLTAGE VALUE
8d — CHANGE IN INTEGRATED ELECTRIC CURRENT VALUE
8e — CHANGE IN SOLUTION TEMPERATURE
8f — CHANGE IN pH VALUE
8g — CHANGE IN PLATING THICKNESS
CHANGE IN PLATING WEIGHT

CHANGE IN PLATING THICKENSS

Graph — PLATING THICKNESS (μm) vs PLATING TIME

PLATING THICKNESS axis (μm): 0.00, 0.50, 1.00, 1.50, 2.00, 2.50, 3.00, 3.50

PLATING TIME axis: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60 S

PLATING VALUE (μm): 0.00, 0.25, 0.44, 0.70, 0.95, 1.60, 1.90, 2.07, 2.15, 2.20, 2.24, 2.31, 2.48

CALIBRATED IN 5 ▷ SECONDS ▷

INPUT RESULT

PRE-PLATING WEIGHT	155.663	g
POST PLATING WEIGHT	155.798	g
DEPOSITED PLATING WEIGHT	0.135	g

OK

| AVERAGE CATHODIC ELECTRIC CURRENT EFFICIENCY | 93.2 | % |
| FINAL AVERAGE PLATING THICKNESS | 2.436 | μm |

ELECTRIC CURRENT VALUE	2.000	A
VOLTAGE VALUE	5.00	V
INTEGRATED ELECTRIC CURRENT VALUE	50.000	C
SOLUTION TEMPERATURE	50.0	℃
pH VALUE	5.4	pH
PLATING THICKNESS	2.5	μm
PLATING WEIGHT	0.146	g

PLATING TIME 25 S

TO EXPERIMENTAL RESULT NUMERIC VALUE FORM

8

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FIG. 9

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EXPERIMENTAL RESULT NUMERICAL VALUE FORM

NAME OF EXPERIMENT	Wafer Experiment No. 001	WAFER-Ni001		YAMAMOTO, Wataru	10 November, 2000
NAME OF PLATING SOLUTION	Nickel-plated–Sulfamic Acid Solution	NAME OF ITEM	Wafer Specimen	MATERIAL OF ITEM	Si/Ti/Cu

PLATING TIME(S)	ELECTRIC CURRENT VALUE(A)	VOLTAGE VALUE(V)	INTEGRATED ELECTRIC CURRENT VALUE(C)	SOLUTION TEMPERATURE(°C)	pH VALUE(M)	PLATING THICKNESS(m)	PLATING WEIGHT(g)
0	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
1	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
2	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
3	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
4	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
5	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
6	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
7	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
8	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
9	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
10	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
11	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
12	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
13	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
18	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
19	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
20	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
21	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
22	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
23	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
24	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
25	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
26	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
27	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
28	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
29	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
30	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
31	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

SAVE IN CSV FORMAT